



TOPIC TALK

**BIOREMEDIATION FOR
WIDESPREAD RESIDENTIAL, PARK,
AND SCHOOL CONTAMINATION
POST-FIRE LOS ANGELES**

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**Executive & Scientific Director,
Center for Applied Ecological Remediation**

The background image shows a field of green, leafy plants, likely a cover crop used in bioremediation. Several orange plastic flags are planted in the ground among the plants. In the distance, there are trees and a building under a clear sky.

CALRC Topic
Talk

Bioremediation for Widespread Residential and Park and School Contamination Post-Fire Los Angeles

Dr. Danielle Stevenson | Center for Applied Ecological Remediation



How Many Homes Were Destroyed by the 2025 LA Fires?

The 2025 LA wildfires burned over 57,000 acres and destroyed more than 16,000 structures. The two most destructive fires were the Palisades and Eaton fires:

Palisades Fire



6,833 structures lost
23,448 acres burned

Eaton Fire



9,418 structures lost
14,021 acres burned

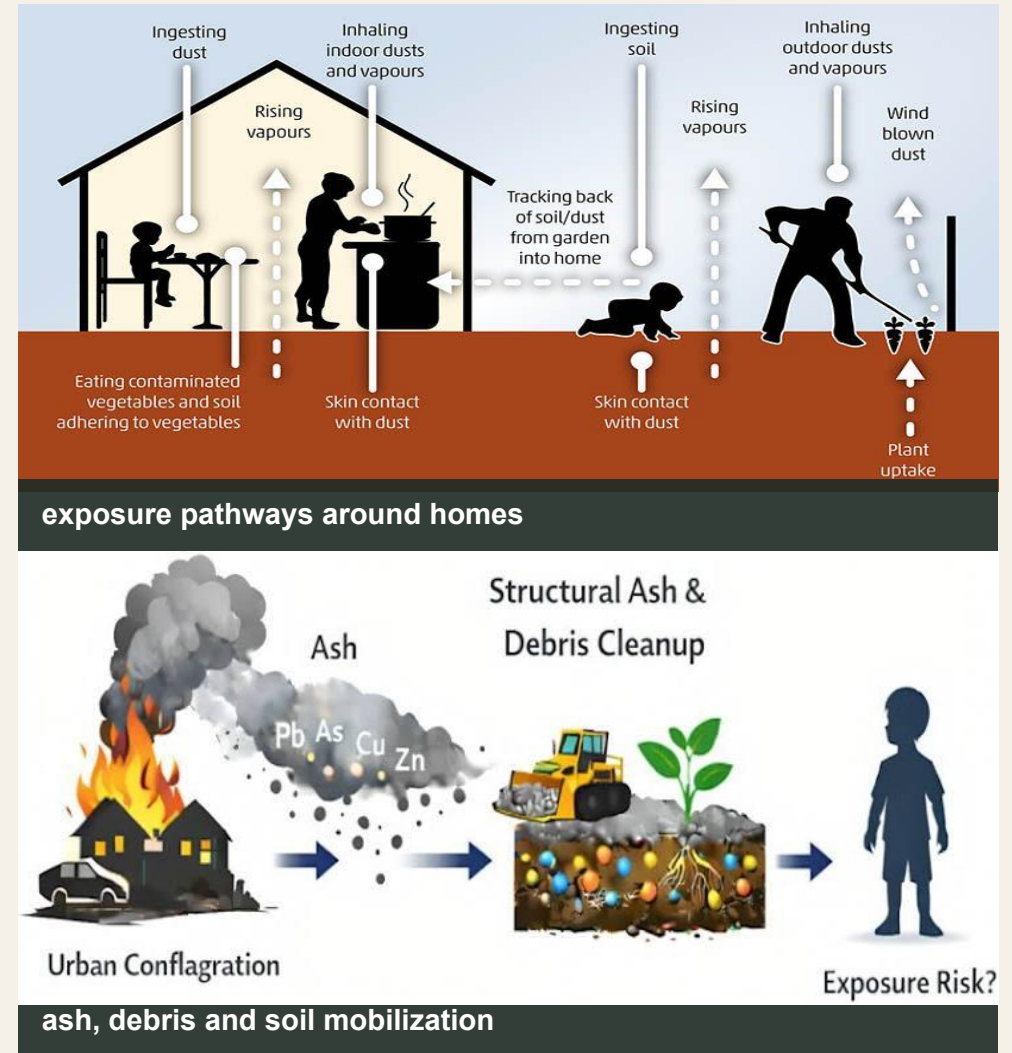
Source: [fire.ca.gov](https://www.fire.ca.gov)

THE PROBLEM

An urban conflagration creates a different cleanup problem and scale



Not one controlled footprint — many small, exposed, variable sites.



Dossou SA et al. Urban Conflagrations: Structural Ash and Soil Metal(loid) Contamination after California's Eaton and Palisades Fires. Environ Sci Technol Lett. 2026

Common Post-Fire Contaminants

Metals

- lead (Pb), arsenic (As), mercury (Hg), hexavalent chromium (CrVI)

Volatile Organic Compounds (VOCs)

- benzene, formaldehyde, acetone, etc.

Semi-volatile Organic Compounds (SVOCs)

- nitroaromatics, PCBs PAHs, phthalates

Dioxins and furans

Petroleum hydrocarbons

- gasoline-range (GRO)
- diesel-range (DRO)
- Oil Range Organics (ORO)
- total petroleum hydrocarbons (TPH)

Per- and polyfluoroalkyl substances (PFAS)

- PFOS, PFOA

Asbestos

Remediation strategies either...

REMOVE CONTAMINANTS

- By removing soil
- or by removing contaminants from soil



REDUCE EXPOSURES TO CONTAMINANTS

- By covering / capping the soil
- By diluting the contaminants
- By stabilizing the contaminants in the soil





DIG

remove and replace soil



COST



MAINTENANCE



None

TIME



Fast



CAP/STABILIZE

cover or stabilize soil
contaminants



\$



Ongoing



Fast



SUSTAINABLE TREATMENT

nature-based remediation
aka bioremediation to clean
the soil in place



\$\$



None once
complete



Slow

CLIMATE + SCALE

Disaster-scale contamination requires disaster-scale cleanup options



FIRE

Urban and wildland fires can generate ash, debris and widespread soil contamination.



FLOOD

Flooding and erosion can redistribute contaminated sediments and spread pollution across new areas.



SCALE

As climate risks grow, more communities will need cleanup approaches that can work across large areas and limited budgets.



Excavation and disposal remain important for hotspots — but disaster-scale cleanup cannot rely on digging and landfilling every affected site.

The cleanup toolbox must combine targeted removal, containment and in-place treatment.

Biological remediation is an alternative remediation method that works with living organisms (fungi, plants, microbes) to address contaminants in the environment.

- can be done in situ, reducing or removing need for soil excavation
- 50-90% cost savings compared to dig and dump



PLANTS

Phytoremediation



FUNGI

Mycoremediation



BACTERIA

Microbial remediation

SCALE

Can bioremediation scale across homes, parks / open space, and schools after disasters?



47 properties — 500 applied

A distributed residential program concentrated in Altadena, with additional Palisades properties for high-need, high-risk households.



Public sites

Parks, greenways and other public sites require different access, stewardship and ecological management rules. Public access, habitat, irrigation systems, maintenance crews and permitting all shape design.



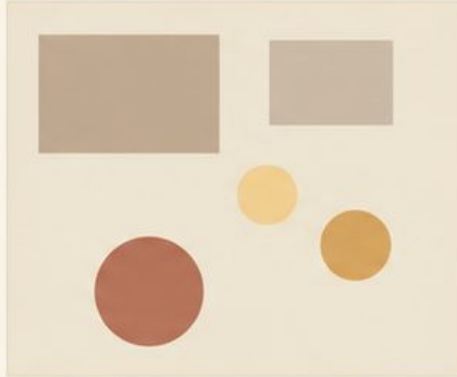
Sensitive receptors

Schools with children require more stringent cleanup planning, institutional approvals and higher certainty about exposure reduction.

Scaling means deciding what can be standardized — and what must remain site-specific.

SITE HETEROGENEITY

One neighborhood does not mean one contaminant profile



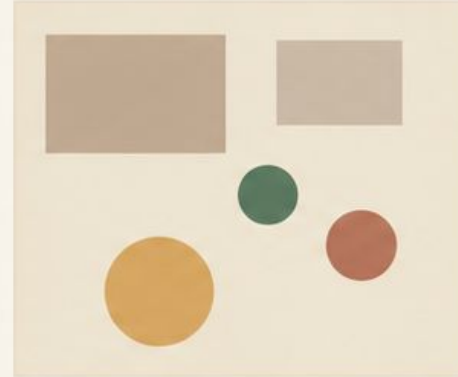
Property A

surface Pb hotspot



Remove / cap first

Use faster or higher-certainty controls where exposure or concentration demands it.



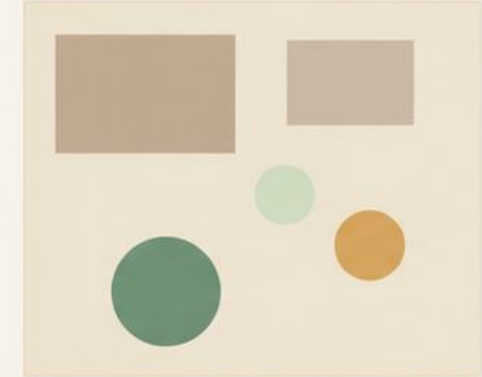
Property B

mixed metals + organics



Hybrid remedy

Target hotspots conventionally and use ecological treatment across lower-level areas.



Property C

lower levels + rebuild constraints



Treat biologically

Use plants, fungi, microbes and amendments where the biology can plausibly function.

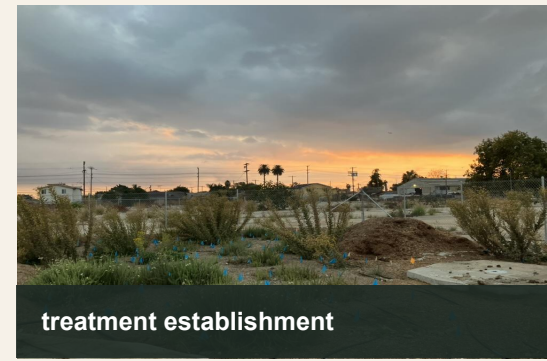
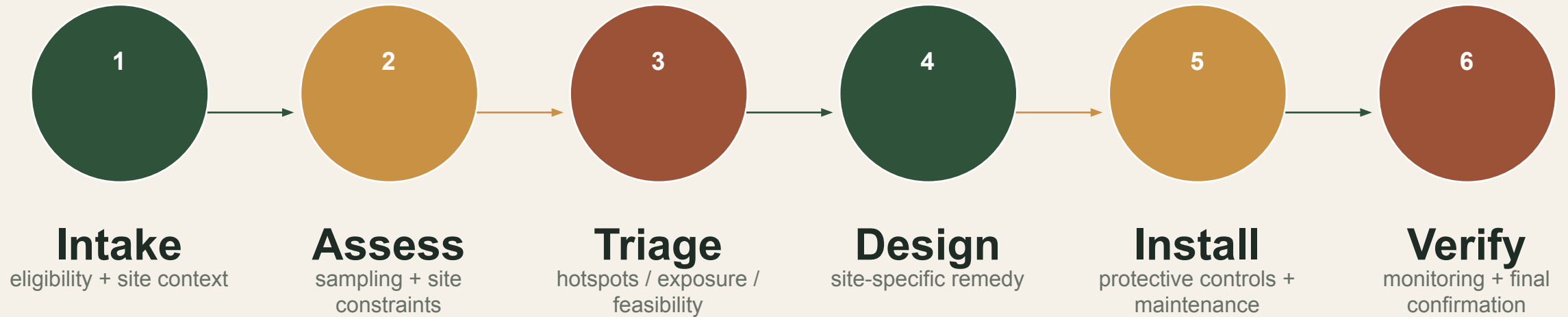
What creates variability?

Ash deposition, materials burned, prior land use, cleanup history, erosion / runoff patterns, soil texture and rebuilding activity.

Standardize the process — not the remedy.

THE PROGRAM ARCHITECTURE

A scalable workflow



REMEDY SELECTION

Treatment design involves matching the biological function to the site needs

Match the contaminant, the biological mechanism and the site constraints to the cleanup endpoint.



hyperaccumulator plants



mycorrhizal fungi



decomposer fungi



Metals

Plants + root-associated fungi can support extraction, stabilization or exposure reduction, depending on the contaminant and endpoint. Metals do not biodegrade.



Organic contaminants

Decomposer fungi, bacteria and carbon/soil amendments may be used where biodegradation is plausible. Success must be confirmed by measured contaminant reduction.



Hotspots / unsuitable areas

Targeted removal, capping or other conventional methods can be paired with biological treatment where concentration, exposure or feasibility demand it.



Site fit

Depth, concentration, soil chemistry, water, rebuilding schedule and future land use all affect the design.

Choose the least-disruptive approach that can credibly reach the cleanup objective.

IMPLEMENTATION

Bioremediation lifecycle



1

Assess

Comprehensive soil testing and site assessment.



2

Design

Develop the site-specific bioremediation strategy.



3

Install

Install plants, fungi, amendments and protective controls.



4

Monitor & verify

Track soil, plants and treatment progress until remediation goals are reached.



5

Test & manage byproducts

Harvested plants, mushrooms and other remediation biomass may require testing, containment and proper disposal.

BIOREMEDIATION TIMELINES

Bioremediation is a natural process—timelines depend on the **context**.

TIMELINE DEPENDS ON:



CONTAMINANT TYPE & CONCENTRATION

Some contaminants are easier (and faster) for microorganisms and plants to break down or remove than others.



SITE CONDITIONS

Soil type, pH, moisture, oxygen, nutrients, and contaminant aging all affect rates.



CLIMATE

Temperature, rainfall, and seasonality influence microbial activity and plant growth.



DESIGN & IMPLEMENTATION

Treatment approach, amendments, plants, microbes, and maintenance all impact effectiveness.



ONGOING MONITORING

Regular testing and adaptive management help optimize performance over time.

CONTEXT MATTERS



Timelines can vary widely from site to site. The ranges below are general estimates for well-designed projects.



TYPICAL TIMEFRAMES BY CONTAMINANT TYPE



ORGANIC CONTAMINANTS

Broken down by microorganisms



Petrochemicals (TPH, gasoline, diesel)



Other organics (solvents, pesticides)



METAL CONTAMINANTS

Removed or stabilized by plants, microbes, and soil processes

Zn

Zinc, Copper, Nickel (and similar metals)

As

Arsenic

Pb

Lead



Patience, monitoring, and the right conditions lead to lasting results.



BOUNDARIES

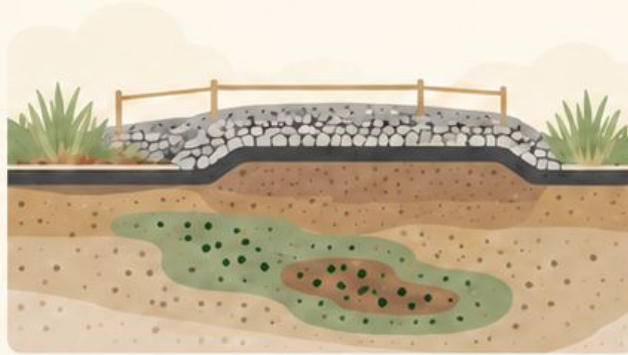
Where bioremediation fits — and where it does not

Good standalone fit



- Shallow, accessible contamination
- Low–moderate concentrations
- Months-to-year timeframe
- Water + maintenance pathway
- Clear monitoring endpoint

Combine with other controls



- Hotspots within broader lower-level contamination
- Dust or exposure needs interim controls
- Rebuilding or public access requires phasing
- Biological treatment useful after removal/capping

Not appropriate by itself



- Acute exposure or urgent occupancy
- Very high-concentration hotspots
- Deep contamination beyond biological reach
- No irrigation / maintenance access
- Endpoint needs greater certainty or speed

Responsible scaling means knowing when to use bioremediation, combine it, or say no.

A disaster-recovery cleanup model that can scale without becoming one-size-fits-all

- 1 Shared infrastructure for assessment, QA/QC and monitoring
- 2 Site-specific treatment decisions
- 3 Targeted conventional cleanup where needed
- 4 In-place ecological treatment where appropriate
- 5 Evidence-based endpoints and transparent reporting

The question is no longer “Can bioremediation work?” It is “How do we deploy it responsibly across a community?”

PLEASE DO
NOT HARVEST
HERE
BIOREMEDIATION
OF HEAVY
METALS IN-
PROGRESS

The Centre for Applied Ecological Remediation (CAER)

CAER is a 501(c)(3) nonprofit organization advancing science-based ecological remediation to address environmental pollution.

Our mission is to:



Advance research and application of ecological remediation to equitably address pollution



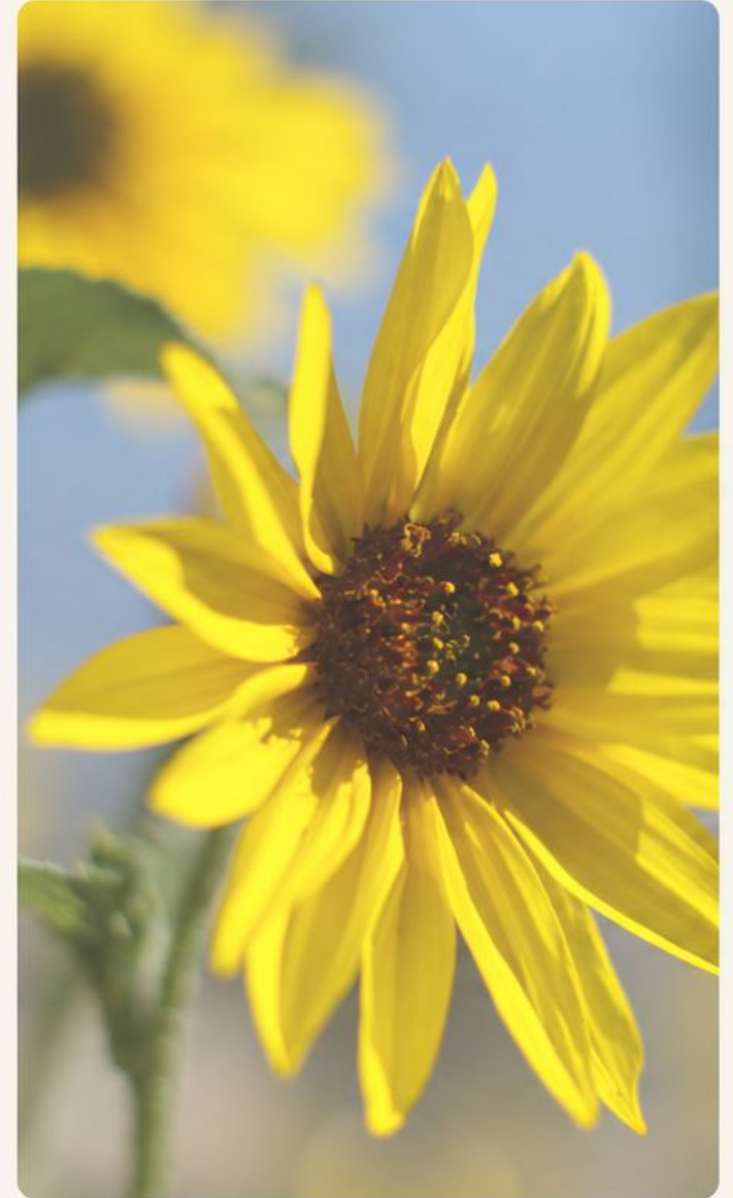
Promote public health



Provide education and workforce development



Build climate resilience



The background image shows an outdoor site for ecological remediation. In the foreground, there are several blue and white triangular flags planted in the ground. A person wearing a dark jacket and a face mask is crouching on the left, working with the flags. On the right, another person wearing a blue jacket, a white hard hat, and a black face mask is standing and looking at a clipboard. The ground is covered with dark soil and some green plants. In the background, there is a large, light-colored stone wall with small rectangular openings. To the right of the wall, there is a black metal fence and a red and white striped barrier.

Centre for Applied Ecological Remediation

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Civic Bioremediation

Building a Network of Soil Practicioners



	○ Excavation & Disposal	● Capping	● Immobilization	○ Bioremediation
BEST FOR	All common contaminants	All common contaminants	Many metals; some PFAS	PAHs; some metals & PFAS
COST	Up to \$50,000+	~\$10k–\$100k	~\$10k–\$50k	~\$10k–\$50k
TIMELINE	Days–weeks (fast)	Days–weeks	Days–weeks	Weeks–years
SCIENTIFIC CONFIDENCE	High	High, if maintained	Low–moderate	High PAHs · Mod metals · Low PFAS
MAINTENANCE	NONE	LOW–MEDIUM	HIGH	HIGH
TESTING	Once, after	Annual / if disturbed	Long-term monitoring	Ongoing + final

<https://consortium-science.com/soil-guide.html>



CALIFORNIA LAND RECYCLING CONFERENCE

Imagine | Innovate | Implement
September 29 – October 1, 2026 | Foster City

THANK YOU!

**IMAGINE, INNOVATE, IMPLEMENT
THE FUTURE OF LAND RECYCLING**



We appreciate your feedback, follow this QR code
to submit an evaluation form on Whova.

**Join the conversation, use #CALRC2026 to share
your photos, insights and highlights!**



OFFICE OF BROWNFIELDS
Department of Toxic Substances Control - Cleanup in Vulnerable Communities Initiative



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